

MECHANICAL ENGINEER

AN EXPERIMENTAL INVESTIGATION OF THE BOW WAVE ON *USS COLE* (DDG-67)

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This is an experimental investigation into the formation of the bow wave on *USS COLE* (DDG-67) and her 1/250 scale model. The experiment examines the bow wave from a hydrodynamic signature point of view. Previous experiments have looked at the phenomenon from an icing, deck wetness or hull resistance standpoint. Very little research has emphasized the importance to the Navy of the effects of the bow wave and subsequent spray on the overall radar cross-section and stealth of the vessel. Measurements were conducted on a 1/250-scale model and compared to video of the *USS COLE* (DDG-67) wherever possible. The effects of steady, heave, pitch and combinations of heave and pitch motions were studied to quantify the base flow in comparison to the *USS COLE*. The Froude Number for the majority of the work was 0.25. Model scale frequencies ranged from 1 to 5 Hz, pitch angles from 0.85 degrees to 3.75 degrees and heave amplitudes from 1/8 to 1/2 of an inch. This research, coupled with subsequent studies of sheet separation and a physics based understanding of all the mechanisms, is essential to developing a numerical model that could begin to predict the basics of the highly complex bow wave and spray region.

VALIDATION OF LOW OBSERVABLE STACK EDUCTOR DESIGN FOR GAS TURBINE EXHAUST SYSTEMS

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An experimental and analytical program was conducted to improve the entrainment performance of a low aspect ratio mixing tube (about unity) eductor. A new primary flow pattern, consisting of eight high aspect ratio, pie-shaped nozzles, was designed to increase mixing and product better outlet flow uniformity. The aerodynamic performance of the new design was measured in a 1/5 scale, cold-flow facility, and the results compared to a nozzle plate with 16 constant-width, radial nozzles. Experimental results are presented for a range of conditions and include the effects of mixing tube misalignment and inlet blockage. The new nozzle is shown to increase the secondary pumping ratio by 7%. In addition, a one-dimensional, steady, analytical model of an eductor, which includes frictional losses and outlet momentum non-uniformity is presented. The model predicts the performance of real eductors to within 3% and shows that the momentum non-uniformity is the primary factor limiting performance.

